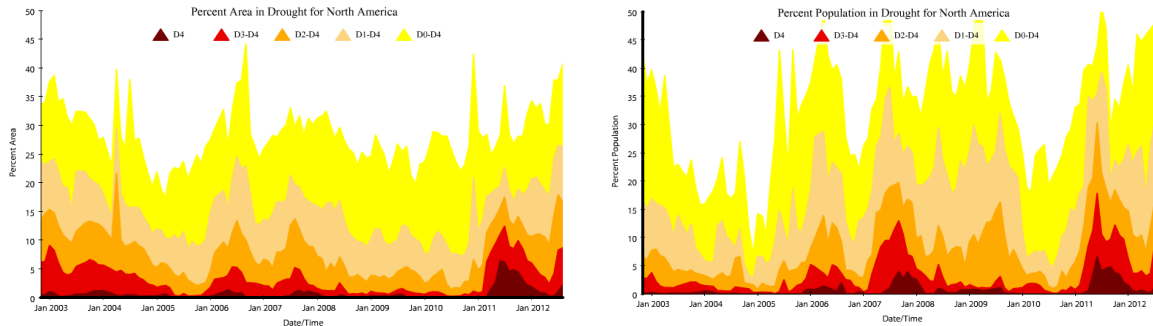


North American Drought Monitor - August 2012

At the end of August 2012, moderate to exceptional drought (D1-D4) affected approximately 26.4% of the area and 27.5% of the population of North America. These percentages are about the same for area and a decrease of 3.0% for population compared to the end of July.



CANADA: August brought high heat and low rainfall to most regions of Canada. The hot, dry weather intensified drought conditions throughout Eastern Canada, and took moisture out of the ground in the west, southern Ontario, southern Quebec, and the Atlantic region. The heat affected annual crops, forages and pasture land everywhere. Moderate drought remained in northeast British Columbia, northwest Alberta, and southern Manitoba.

Extreme Drought (D3) persisted in southern Ontario within areas southwest of Toronto and those surrounding Ottawa. Though August rainfall was near normal, over the past three months it was less than half in, and since September 2011 the deficit is over 240 mm (9.6 in) in the driest areas. Monthly river flows remained down to less than 30% of normal in these areas. Harvest progressed throughout the month with crop yields that were lower than average, and the lack of soil moisture impacted winter wheat planting. Tree fruits, which were already suffering from an early season frost, were also affected by the dry conditions; peach, pear, and plum yields are forecast to be down 30, 60, and 33 percent, respectively. Level 1 and Level 2 low water advisories were maintained across more than twenty Ontario Conversation Authorities. The Level 1 and 2 advisories call for voluntary water use reductions of 10 and 20 percent, respectively.

Across southern Ontario, the lack of rainfall was accompanied by high temperatures. Since April 1 the area is short over 100 mm (approximately 4 inches). The Hamilton area in particular has had about half of its normal rainfall between March and August. Producers began supplementing their cattle's feed on pasture in late July as green grass completely dried up. Some in the area sought to import barley from the west for feed stock. The price of hay in the area has tripled, with large round bales that normally sell for \$30 going for \$100 or more. Good quality dry hay was going to US dairies for 18 cents per pound, whereas normally it would be 6 cents per pound. Reports indicated that some producers were travelling over 500 km to purchase hay. Producers shipping cows to local market found prices dropped about 20 cents per pound from earlier this year. Despite the lower

prices more sell offs are expected. Altogether Ontario's cattle herd has retracted by 20% since 2004.

Drought conditions in southwest Quebec also worsened in July. Much of the region is short over 125 mm (5 inches) since April 1. As a result, second cut hay production was lower than normal, and yields for most annual crops in the region are forecast to be average at best. Parts of northeast Ontario and northwest Quebec remained classified as Abnormally Dry (D0); over three months this area is short 60 to 80 mm (2.4 to 3.2 inches) of moisture. Numerous wildfires continued throughout Ontario. Over 1,100 fires have already been reported this year, twice the ten-year average. Across Quebec, a provincial fire ban was instituted.

In Atlantic Canada, Moderate Drought (D1) occurred in eastern Prince Edward Island and western Nova Scotia. Rainfall remained below average in August, little more than half of normal in many places. Since April 1 these areas are over 120 mm (4.5 in) short of moisture. Crops were parched in the dry conditions, and irrigation ponds were drawn down to exceptionally low levels. Vegetable yields came in smaller than average. However, the warmer and drier conditions were welcomed by wine makers, who expect a stellar crop.

Drought and abnormally dry conditions occurred in Western Canada. Due to above average spring rainfall drought was not an initial concern for most regions, but low rainfall through August drove soil moisture reserves down across southern Alberta and Saskatchewan. Southern Manitoba remained in Moderate Drought (D1), where less than 70 percent of normal rain has fallen since April 1. On-farm water supplies remained lower than normal in the southeast area. Reports indicated that pastures north of Winnipeg and in the southwest region of Manitoba will be done by the end of September, which would bring about the need for supplemental feeding. Hay production was reported to be 10 to 20 percent lower due to the drought, though annual crops were faring well as harvest began.

Drought expanded across the Peace River region of northeast British Columbia and northwest Alberta. Since September 2011, the areas on the Alberta side are short over 120 mm (4.5 in) of precipitation. Annual crops fared well with some timely rainfall, but long-term impacts to forage and pasture are a concern. Low stream flow advisories continued throughout the British Columbia region, and grain crops were suffering from water stress. Crop yields are forecast to be slightly below average as a result. The hay yield is also expected to be below average. On the British Columbia side, precipitation has been below normal over the past three months, and median stream flow remained much less than average.

Acknowledgements: We acknowledge and thank the following organizations whose reports and assessments were consulted to produce the Canadian portion of the North American Drought Monitor:

- AAFC-AESB District and Regional Offices
- Alberta Environment
- Alberta Agriculture and Rural Development
- B.C. Ministry of Environment – River Forecast Centre
- B.C. Ministry of Forests & Range, Wildfire Management Branch
- B.C. Ministry of Agriculture and Lands
- Environment Canada
- Manitoba Agriculture, Food and Rural Initiatives – Ag-Weather Program

- Manitoba Water Stewardship
- Natural Resources Canada – Canadian Forest Service
- Ontario Ministry of Natural Resources – Surface Water Monitoring Centre
- Ontario Ministry of Natural Resources – Aviation, Forest Fire and Emergency Services
- Saskatchewan Ministry of Agriculture
- Saskatchewan Watershed Authority
- Saskatchewan Environment Fire Management and Forest Protection Branch

UNITED STATES: The weather pattern over the United States during August 2012 consisted of a battle between subtropical high pressure (High, or upper-level ridge) to the south and the polar jet stream and associated storm track to the north. The jet stream frequently pushed upper-level troughs and cool fronts into the High over the eastern U.S., while the remnants of Hurricane Isaac moved up the Mississippi Valley at the end of the month and became absorbed into a cool front along the Ohio Valley at the beginning of September. When averaged over the month of August, this pattern resulted in warmer-than-average temperatures beneath an upper-level ridge over the western U.S. and cooler-than-average temperatures beneath an upper-level trough over the Southeast. Although summer monsoon showers brought above-normal precipitation to parts of the Southwest, descending air ("subsidence") associated with the High dominated the West and Great Plains, resulting in below-normal precipitation from the Pacific Northwest to the Great Plains. Numerous wildfires broke out in the hot, dry, windy weather across the West and Plains, giving August 2012 a record high acreage burned. This weather pattern inhibited the formation of tornadoes, with the preliminary national count of 52 tornadoes being below the long-term average. Of the tornadoes that did occur, many were associated with Isaac.

The weather pattern during August shielded the U.S. mainland from most tropical activity. Of the six Atlantic Basin tropical storms and hurricanes that formed during the month, only Isaac made landfall. And while significant flooding occurred with Isaac, especially along the Gulf coast (Louisiana and Mississippi had the second wettest August on record), its rains brought relief to some parts of the Midwest drought area. Beneficial rains contracted the drought area in the Southeast and rainfall from Isaac improved drought conditions in the Lower Mississippi and Ohio valleys. But drought expanded in the West and intensified in the Great Plains beneath the hot, dry ridge. According to the end-of-August (August 28) U.S. Drought Monitor (USDM), 62.9% of the contiguous U.S. (52.6% of the U.S. including Alaska, Hawaii, and Puerto Rico) was affected by moderate to exceptional drought overall. These values are about the same as the end of July. However, the areas affected by the worst drought categories (extreme and exceptional drought, D3-D4) increased, indicating that the drought has gotten more intense. According to the Palmer Drought Index, which goes back to the beginning of the 20th century, 55.1% of the contiguous U.S. was in moderate to extreme drought at the end of August, a decrease of about 3% compared to last month. The percent area in severe to extreme drought increased to 39.0%, confirming that the drought has intensified. The 2012 Palmer Drought Index percent area values have been exceeded only by the droughts of the 1930s and 1950s.

The core drought areas in the U.S. at the end of August included:

- a large area of moderate (D1) to exceptional (D4) drought stretching from the central Rockies, across the central and southern Plains, into the Mid-Mississippi and Ohio valleys and southern Great Lakes;
- a contracting area of moderate to exceptional drought in the Southeast;
- an area of moderate to severe (D2) drought in the Mid-Atlantic, with areas of moderate drought in the Northeast;
- an expanding area of moderate to extreme (D3) drought across much of the West; and
- much of Hawaii, where moderate to extreme drought persisted.

Spatial and Temporal Characteristics: The temporal nature of the drought varies from region to region and is summarized here based on maps of the Standardized Precipitation Index (SPI), which measures moisture supply (the spatial extent of both anomalously wet and dry areas), covering time scales ranging from 1 month to 24 months. The 1-month (August 2012) SPI shows the main area of dryness from the Pacific Northwest to the Central Plains, with other areas dry in the Upper Midwest, Southern Plains to Southern Rockies, and mid-Appalachian Mountains. The Northwest and Northern Rockies are dry at 2 months (July-August 2012), but wet conditions dominate there at 3 to 9 months. The summer monsoon in the Southwest is evident from 1 to 3 months, with neutral to dry conditions dominating at 9 to 24 months. Dryness is widespread from the Central Rockies, across the Plains, to the Midwest from 2 to 12 months, especially at 3 to 6 months. The Southeast and parts of the Midwest are wet at 1 to 2 months, but the Southeast wetness becomes limited to the Gulf and Atlantic coasts from 3 to 12 months, with a dry core becoming evident around Georgia at 6 months and stretching to 24 months (September 2010-August 2012). Dryness dominates in the Southern Plains at 24 months, while the northern tier states are wet. Wetness extends from New England to the Southern Appalachians at 12 and 24 months.

Historical Perspective: According to preliminary data at the NOAA National Climatic Data Center (NCDC), nationally, the U.S. had its 16th warmest in the 1895-2012 record. Over a fifth (21%) of the U.S. was very dry (the driest ten percentile of the historical record) but the dryness was partially balanced out by a significant area (9%) that was very wet (the wettest ten percentile of the historical record), resulting in a national precipitation rank for August 2012 of 57th driest August in the 118-year record. On a statewide basis, August 2012 ranked in the top ten driest Augusts for six states – from the Northwest to the Central Plains – and ranked as the driest August for Nebraska, Washington, and Wyoming.

The spatial pattern of dryness at the three month time scale stretched from the Rocky Mountain states to the Ohio Valley and parts of the Northeast. Again, Nebraska and Wyoming had the driest June-August on record with six other states having the tenth driest, or drier, June-August. The spatial pattern of dryness at the six month and year-to-date time scales was similar to the summer (June-August) pattern. Delaware and Wyoming had the driest March-August on record with eight other states ranking in the top ten driest category. At the year-to-date time scale, Delaware had the driest January-August on record, Colorado, Nebraska, and Wyoming ranked second driest, and six other states fell in the top ten driest category. At the 12-month time scale, dryness dominated from the West to the Midwest. September 2011-August 2012 ranked in the top ten driest category for six states,

with Delaware, Nebraska, and Wyoming each ranking second driest for September 2011-August 2012.

August 2012 had near to below-normal temperatures for the Midwest to Southeast, interrupting a warm streak for that part of the country, but record to near-record heat occurred for states in the West. For most of the last twelve months, the extreme dryness has been accompanied by extreme heat for the drought areas across the country. For example, both Colorado and Wyoming had the hottest summer on record and Nebraska and Wyoming had the driest summer on record. Excessive heat increases evapotranspiration and exacerbates drought. The Palmer Z Index integrates the effects of heat and dryness. The combination of driest and third warmest summer gave Nebraska the second most severe June-August averaged Palmer Z Index in the 1895-2012 record, behind 1936. The driest and warmest summer gave Wyoming the most severe June-August averaged Palmer Z Index on record. The dryness and excessive heat have been so persistent for the state that Wyoming has had the most severe averaged Palmer Z Index for the last six months (March-August) and the third most severe averaged Palmer Z Index for the last twelve months (September-August) (behind 1934 and 2002).

The Primary Corn and Soybean agricultural belt has been especially hard hit by drought this year. Each month of the growing season has had significant short-term dryness (as measured by the Palmer Z Index). This region, collectively, has experienced the warmest and seventh driest March-August in 2012, resulting in the fourth most severe Palmer Z Index (behind 1936, 1934, and 1988). The extreme severity of the dryness and evapotranspiration demand over the growing season resulted in a rapid increase in the percent area of this agricultural belt experiencing moderate to extreme drought (as defined by the Palmer Drought Index) and moderate to exceptional drought (as defined by the USDM). The August rains in the eastern part of this region were beneficial and helped reduce the intensity of the drought there, but they did little to shrink the overall drought area for the entire region. By the end of August 2012, about 83% of the Primary Corn and Soybean Belt was experiencing moderate to extreme drought (based on the Palmer Drought Index), surpassing all previous droughts except those in 1988 and the 1930s.

Agricultural and Hydrological Highlights: Nearly 700 (699) impacts were reported to the Drought Impact Reporter (<http://droughtreporter.unl.edu>) during August, a decrease from the 945 reported in July. Most were felt in the agriculture sector, followed by the water supply sector, but significant counts were noted in the business, fire, and ecosystem sectors. Missouri was the epicenter of the reports, but many were also generated out of Colorado, Nebraska, Kansas, Oklahoma, Texas, Iowa, Illinois, Indiana, and Arkansas. Based on end-of-August (August 26) U.S. Department of Agriculture reports, 52% of the nation's corn crop was rated in poor to very poor condition. This is slightly more than the 48% at the end of July. Thirty-eight percent of the national soybean crop was rated poor to very poor (compared to 37% a month ago), 50% of sorghum (42% last month), and 59% of the nation's pasture and rangeland (57% last month). In some states, nearly all of the pasture and rangeland was rated poor to very poor (Missouri at 99%, Nebraska 95%, Kansas 92%, Illinois 90%). In the waning days of the growing season, crop condition changed little during the first two weeks of September, although pastures and rangeland improved in some areas from the rains of Isaac (as of September 9, Missouri had 92% in

poor to very poor condition while Illinois dropped to 62% and Arkansas to 68% [from 84%]). But on a national scale, little improvement occurred with 83% of corn, 80% of soybeans, and 72% of cattle still in drought (as of September 4). The drought has taken a toll on the nation's soil moisture, with virtually all of the topsoil in the Rocky Mountain to Central Plains states short or very short of moisture. The rainfall from Isaac improved soil moisture conditions in Arkansas, Missouri, Illinois, and Indiana during the first week of September. Large parts of the country, from the southern High Plains to the western Great Lakes, and part of the Southeast, had much below average monthly streamflow. Many groundwater gauges measured record low groundwater levels in these areas and in the Ohio Valley and eastern Great Lakes.

MEXICO: In August, hurricane Ernesto, which was active from August 1-10, made landfall on the 7th and brought large amounts of rainfall from the Yucatan Peninsula to the Pacific Coast of Mexico. In its wake, the storm set 24-hour records of 129.0 mm in Quintana Roo (5 in), 273.8 mm in Tabasco (10.7 in), 353.0 mm in Veracruz (13.9 in) and 180.0 mm in Puebla (7.1 in). Tropical Storm Helene (August 9-18) impacted areas from southern Tamaulipas to northern Veracruz with amounts up to 186.0 mm (7.3 in) in the weather station of Tierra Blanca, on the 17th. On the Pacific coast two tropical systems formed: Tropical Storm Hector (Aug. 11-17) and Hurricane Ileana (Aug. 27 to Sep. 2). Each brought rainfall amounts of up to 45 mm (1.77 in) and 63 mm (2.5 in), respectively, in Baja California Sur. The rest of the rainfall across the country was related to tropical waves.

Timely rainfall and near normal temperatures helped many areas recover from the long-term drought. The percentage of the country free of drought increased from 54.15% at the end of July to 61.36% by August 31. The most significant recoveries were observed in the Pacific Coastal region from Sonora to Nayarit and between Jalisco and Aguascalientes. In addition, the short-term abnormally dry (D0) areas in the coastal regions of Guerrero and Oaxaca vanished after rains brought by Hurricane Ernesto. At the national level, the mean temperature was 25.9 °C (78.6 °F), which was 2.7 °C above normal and ranked as the fourth warmest August since 1971. Baja California and Chihuahua experienced the third warmest, while Hidalgo and San Luis Potosí averaged the fourth warmest August. Temperatures recorded for Jalisco ranked it as the coolest, while Tabasco was the second coldest. Near normal temperatures were observed from Sinaloa to Sonora, but overall the northeast was slightly above normal.

Areas classified D1-D3 drought decreased from 30% to 23.2% and remain confined to the northern states and the southern tip of the Baja California Peninsula. A slight increase of extreme drought (D3) was observed last month, from 0.84 to 1.13%, most of which remains between Coahuila and Durango, where the NOAA-CPC soil moisture model *Leaky Bucket* had estimated levels that were very below normal. In northern Tamaulipas below normal rainfall was reported over the past two months which allowed for the development of extreme drought (D3), similar to that seen in southern Texas. Overall, statewide precipitation accumulation for the last twelve months ranged from the third wettest in Colima to the sixth driest in Durango.

The Information Service for Agri-food and Fisheries (SIAP) indicated that, due to favorable rains over the country, the area planted to major crops is now 92% of schedule. More than 30,000 ha. (74,131 acre) of grain corn crop were planted in several states including the State of Mexico, Jalisco, Oaxaca, Puebla and Chiapas. Over one million hectares of bean crop were planted in Zacatecas, Durango, Chihuahua and Chiapas, and there was about 480,000 hectares (1.2 million acre) of grain sorghum reported in Guanajuato, Michoacan, Sinaloa and Tamaulipas. Regarding crop losses, the corn grain crop has been the most affected with almost 75,000 ha (185,329 acre). However that is much lower than that recorded one year ago, when San Luis Potosi reported some losses from drought. In Tamaulipas, Veracruz and Nuevo Leon, long-term drought impacts are still evident in orange plantations, as seen in a reduction in production volume over the same time last year. Beef production was also affected, with negative growth in the industry due to herd depopulation as a result of the extreme drought in 2011.

Rainfall up until the end of August helped minimize forest and grass fires, and kept the amount of area burned at much lower levels compared with records of the same period in 2011 and 1998. For wooded area, in 2012 only 27,000 ha (66,718 acre) were burned, that is less than 13% of the 200,000 ha. (494,211 acre) burned in 1998 according to reports of the National Forestry Commission (CONAFOR).